10.3 11/29/2012 - Sec 10.4 Math 1010

64

45

of

exponent

#45 $\log_6 \sqrt{216} = x$

base

$$6^x = \sqrt{216}$$

$$6^x = \sqrt{6^3}$$

$$6^x = (6^3)^{1/2}$$

$$6^x = 6^{3/2}$$

$$x = 3/2$$

#64

$$M(t) = 6 \log_4 (2t+4)$$

t is months

$t = 0 \Rightarrow$ Jan 2008

$\log_4 4 = ?$

$4^? = 4^1$

a) January 2008 $t = 0$

$$M(0) = 6 \log_4 (2 \cdot 0 + 4)$$

$$= 6 \log_4 4 = 6 \cdot 1 = 6$$

$=1$

b) July 2008

$t = 6$

$\log_4 16 = ?$

$4^{?} = 16$

$4^{?} = 4^2$

$M(6) = 6\log_4(2\cdot 6+4)$

$= 6\underbrace{\log_4 16}_{=2}$

$= 6\cdot 2$

$= 12$

c) July 2010

$t = 30$

$\log_4 64 = ?$

$4^{?} = 64$

$4^{?} = 4^3$

$M(30) = 6\log_4(2\cdot 30+4)$

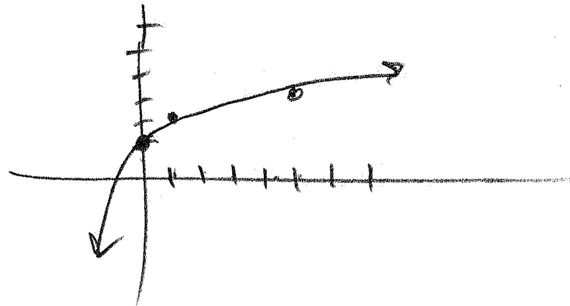
$= 6\underbrace{\log_4 64}_{=3}$

$= 6\cdot 3$

$= 18$

d)

t	y
0	6
6	12
30	18



Sec 10.4 Properties of Logarithms

Exponent Properties pg 269

$$a^m a^n = a^{m+n} \qquad (a^m)^n = a^{mn}$$

$$\frac{a^m}{a^n} = a^{m-n} \qquad \text{etc.}$$

Product Rule for Logarithms

$$\log_b(xy) = \log_b x + \log_b y \quad ✓$$

why?

let $\log_b x = m$, $\log_b y = n$

$$b^m = x \qquad b^n = y$$

$$xy = b^m \cdot b^n$$

$$xy = b^{m+n}$$

in log form

$$\log_b xy = m+n$$
$$= \log_b x + \log_b y$$

#7 $\log_7(4 \cdot 5) = \log_7 4 + \log_7 5$

$\log_2 5 = 2.3219$ $\quad$ $\log_2 3 = 1.5850$

$$\begin{aligned} \log_2 15 &= \log_2(3 \cdot 5) \\ &= \log_2 3 + \log_2 5 \\ &= 1.5850 + 2.3219 \\ &= 3.9069 \end{aligned}$$

Power Rule for Logaritums

$$\log_b x^r = r \log_b x \quad ✓$$

why?

$$\begin{aligned} \log_b x^3 &= \log_b(x \cdot x \cdot x) \\ &= \log_b x + \log_b x + \log_b x \\ &= 3 \log_b x \end{aligned}$$

$$\log_5 4^2 = 2\log_5 4$$

$$\log_3 \sqrt{x} = \log_3 x^{1/2}$$

$$= \frac{1}{2}\log_3 x$$

$$\log_{10} 5^x = x\log_{10} 5$$

$$\log_3(x^2y^4) = \log_3 x^2 + \log_3 y^4$$

$$= 2\log_3 x + 4\log_3 y$$

Quotient Rule

$$\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$$

#10 $\log_3 \frac{7}{5} = \log_3 7 - \log_3 5$

#23 $\log_a m - \log_a n = \log_a\left(\frac{m}{n}\right)$

#17 $\log_2\left(\frac{\sqrt[3]{x}\cdot\sqrt[5]{y}}{r^2}\right)$

$\log_2\left(x^{1/3}\cdot y^{1/5}\right)-\log_2 r^2$

$\to \log_2 x^{1/3}+\log_2 y^{1/5}-\log_2 r^2$

$\frac{1}{3}\log_2 x+\frac{1}{5}\log_2 y-2\log_2 r$

#31 $3\log_p x+\frac{1}{2}\log_p y-\frac{3}{2}\log_p z-3\log_p a$

$\log_p x^3+\log_p y^{1/2}-\log_p z^{3/2}-\log_p a^3$

$\log_p\left(\frac{x^3 y^{1/2}}{z^{3/2} a^3}\right)$

Inverse Properties

$b^{\log_b x}=x$; $\log_b b^x = x$

$\cancel{5}^{\cancel{\log_5} 12}=12$ $\qquad$ $\log_2 32=\cancel{\log_2} \cancel{2}^5=5$

Product Rule:

$$\log_b xy = \log_b x + \log_b y$$

Power Rule:

$$\log_b x^r = r \log_b x$$

Quotient Rule:

$$\log_b \frac{x}{y} = \log_b x - \log_b y$$

Inverse Properties:

$$b^{\log_b x} = x$$

$$\log_b b^x = x$$

Valid? No

$$\log_b(\underset{\uparrow}{x+y}) \neq \underbrace{\log_b x + \log_b y}_{\uparrow}$$

multiplying

product Rule is $\log_b(xy)$

Valid? No

$$\log_b\left(\frac{x}{y}\right) \neq \frac{\log_b x}{\log_b y}$$

$\log_2 7$ ← calculator ✗

$\log_{10} 7$ ← calculator ✓